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Project SiMoN – New insights into the seismicity and the stress field of the northern Upper Rhine Graben

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The seismicity of the northern Upper-Rhine Graben and its seismic hazard have recently attracted new attention due to the potential of this region for geothermal power generation. The natural seismicity can be used to determine active fault zones and stress conditions within the crust. It also provides important background information for the estimation of possible induced seismicity. The natural seismicity of this area is also interesting because of swarm earthquakes which occurred in the 19th century. The characterization of the natural seismicity in this region is one of the main goals of the project SiMoN (Seismic Monitoring of the Northern Upper-Rhine Graben), which is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Recordings from a network of 13 seismic stations serve as data base for the characterization of natural seismicity in an area of approximately 50 x 50 km in the densely populated Rhine-Main region. We present results of the seismic monitoring programme period since November 2010. The detection threshold is a local magnitude of approximately 1.0, the magnitude of completeness is Mc = 1.2. 33 local earthquakes occurred within the immediate vicinity of the network with magnitudes in the range between ML = 1.0 and ML = 3.2. The majority of the epicenters are located along the eastern shoulder of the Upper Rhine graben, while the western graben shoulder shows almost no activity. The seismicity extends to a depth of 24 km with a pronounced maximum in the depth distribution between 9-12 km. The seismicity in the graben is restricted to lower crustal depths of 9-24 km. In addition to the data recorded by the SiMoN stations we used recordings provided by the regional seismological services to derive focal mechanisms for a total of 37 events. The associated fault-plane solutions show predominantly strike-slip mechanisms. Normal and reverse faulting mechanisms rarely occur. By comparing the nodal planes of the fault-plane solutions with known faults in the investigation area a number of active faults and rupture planes were identified. To derive the principle stress axes an inversion of the focal mechanisms is planned, serving as important background information for the set-up and calibration of a local geomechanical model.